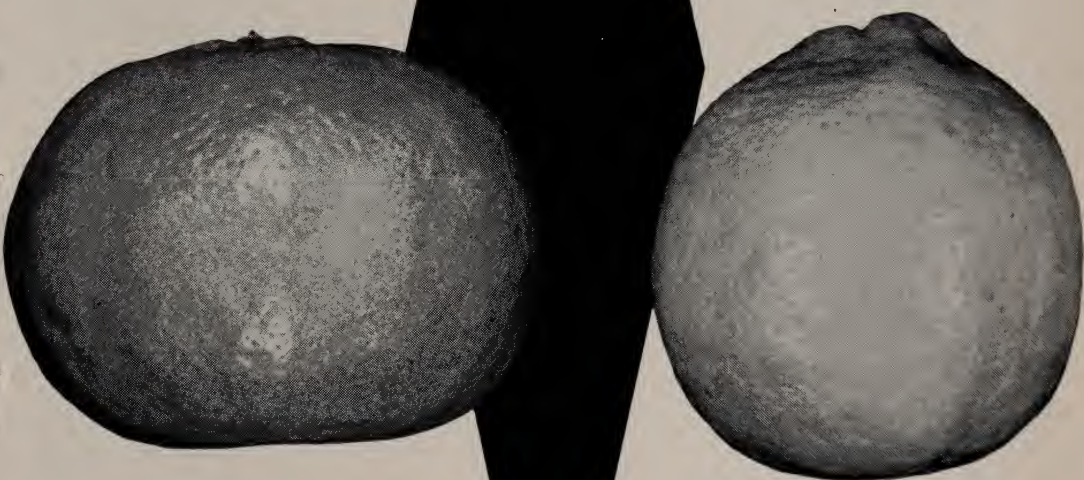




ENCORE and PIXIE

*...two new mandarin hybrids with unusually
late seasons of use*



James W. Cameron
Robert K. Soost
Howard B. Frost

ENCORE AND PIXIE

Two new mandarin hybrids with unusually late seasons of use¹⁾

ENCORE AND PIXIE are two new citrus hybrids, suitable for eating out of hand in late spring to summer. Both were originated at the University's Citrus Research Center in Riverside and evaluated primarily in the Riverside area.

This bulletin contains a description of each hybrid, photograph, and a table of data.

Limited quantities of budwood are available from the authors, at the University of California Citrus Research Center, Riverside.

JUNE, 1965

THE AUTHORS:

James W. Cameron is Geneticist; Robert K. Soost is Geneticist; and Howard B. Frost is Associate Plant Breeder, Emeritus, at the Citrus Research Center and Agricultural Experiment Station, Riverside.

¹⁾ Received for publication January 4, 1965.

MANDARIN varieties whose main seasons of use extend from as late as June to August are rare in all citrus areas of the United States. 'King' (*Citrus nobilis* Lour.) which is perhaps a tangor, is one of the latest maturing such varieties. 'Murcott' (Ziegler and Wolfe, 1961), a variety of uncertain origin and apparently also a tangor, is unusually late in season in both Florida and California. In areas where the spring months are cool, the 'Kara' mandarin is sometimes good in flavor until July. Probably no mandarin fruit can be carried into summer in hot desert areas such as California's Coachella Valley. Very late mandarin types have the disadvantage that their fruit must remain on the tree through the winter and spring. This fruit also meets severe competition from summer-ripening fruits of many other species. Nevertheless, the very scarcity of such citrus types makes them of interest both in the market and for breeding.

The two new hybrids, 'Encore' and 'Pixie,' described here, have unusually late seasons of use. Both were originated at the University of California Citrus Research Center from seed ob-

tained by Howard B. Frost. They were later selected and studied by the other two authors of the bulletin; early testing was slowed by loss of trees due to changes in land use. Both hybrids have been evaluated at Riverside, and the descriptions apply specifically to this climatic area, but some information on 'Pixie' has been obtained from other locations. Neither hybrid has all the characters which make for an ideal variety, but each has an unusual combination of qualities. Both are of good flavor and suitable for eating out of hand. 'Pixie' is almost completely seedless in all tested locations.

'King' appears in the parentage of both of these hybrids. In California, 'King' makes a sparse tree; it is subject to some dieback, and its fruit is often rather rough rinded with considerable rag. However, in breeding studies this variety has repeatedly produced significant proportions of valuable hybrids (Frost and Cameron, In Press; Furr, *et al.*, 1963). Three earlier described mandarin hybrids, 'Kinnow,' 'Kara,' and 'Wilking' (Frost, 1935) all had 'King' as a parent.

The Encore Mandarin

'Encore' is a cross of 'King' (*Citrus nobilis* Lour.) by 'Willow Leaf' mandarin (*Citrus reticulata* Blanco). A budline was maintained at Riverside for some years, after which detailed studies of the hybrid were begun about 1954. The fruit ripens at Riverside from May to June, and usually is good until August or September. Fruit shape is strongly oblate, with little to no neck. Transverse diameter of the fruit is 2 to 3 inches; the height is 1½ to 2½ inches, often slightly unequal on contrasting sides. The rind is thin and

smooth, except for a slight pebbling at the base. Oil glands are many, mostly not raised or depressed, but prominent because of their deep color. A small navel opening is usually present but the inner structure is lacking. Overall rind color is yellow-orange (Ridgway Plate III, 15a to 17b) (Ridgway, 1912), deeper at blossom end than at stem end. The fruit peels easily, with very little albedo adhering to the flesh.

The core is hollow from early maturity, but the fruit is firm and turgid

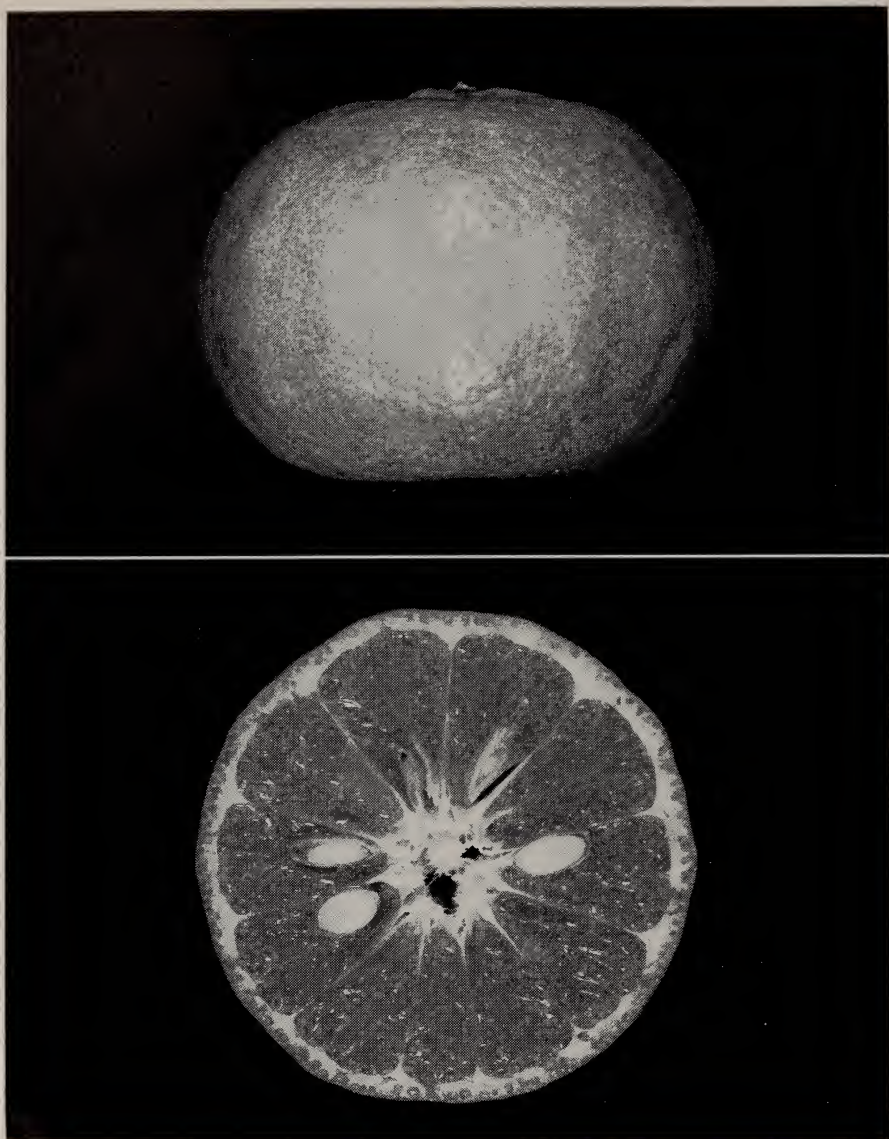


Fig. 1. The Encore mandarin: oblate, easy to peel, and of rich flavor.
Good until August or September at Riverside. Natural size.

with practically no rind puffing. Segments are thin-walled but easy to separate. The flesh is tender, yet firm; juice vesicles are small. Flesh color is deep orange (Ridgway Plate III, 13). Total soluble solids are high to very high; titratable acid is moderate to slightly low, but the fruit may taste tart until midsummer. Tests in several

years (table 1) show that soluble solids and acid were maintained at a satisfactory level from July to September. Tests of 'King' in 1963 and 1964 (table 1) indicate that its levels of solids and acid are similar to those of 'Encore,' but 'King' fruits usually become soft and stale-tasting earlier than those of 'Encore.'

Table 1. FRUIT CHARACTERS OF 'ENCORE', 'PIXIE,' AND 'KING', AT RIVERSIDE
CALIFORNIA, DURING THE SUMMER SEASON IN SEVERAL YEARS.*

Rootstock and sampling date	Weight per fruit	Juice	Soluble solids	Acid	Ratio of solids to acid
	gm	per cent			
Encore mandarin					
Sweet orange					
Sept. 18, 1958.....	132	43.2	16.1	1.29	12.5
Troyer citrange					
July 29, 1960.....	152	48.3	15.2	0.89	17.1
Sept. 12, 1960.....	188	47.8	13.0	0.76	17.1
July 12, 1962.....	149	49.1	15.5	0.89	17.2
July 11, 1963.....	188	44.0	17.3	0.93	18.6
Aug. 28, 1963.....	168	41.1	17.5	0.86	20.3
June 22, 1964.....	117	48.1	13.5	1.04	13.0
Aug. 13, 1964.....	95	51.8	14.8	0.83	17.8
Sept. 7, 1964.....	108	51.2	14.1	0.85	16.6
Pixie mandarin					
Trifoliate orange					
Aug. 10, 1954.....	58	36.8	14.3	0.77	18.6
April 10, 1956.....	57	43.0	15.8	1.15	13.7
June 5, 1956.....	58	44.6	15.4	0.96	16.0
June 18, 1957.....	69	42.9	15.5	0.86	18.0
Troyer citrange and Sweet orange					
July 29, 1960.....	102	38.9	15.3	0.61	25.1
July 12, 1962.....	84	47.5	17.0	0.86	19.8
July 11, 1963.....	70	34.1	13.2	0.60	22.0
Aug. 28, 1963.....	64	26.6	14.3	0.58	24.7
May 19, 1964.....	50	42.3	12.8	0.81	15.8
July 12, 1964.....	52	43.9	13.0	0.62	21.0
King (tangor?)					
Sour orange					
July 11, 1963.....	185	34.4	14.5	0.76	19.1
Aug. 28, 1963.....	212	33.0	15.7	0.82	19.1
Aug. 13, 1964.....	105	42.5	17.1	0.98	17.4
Sept. 7, 1964.....	105	39.7	16.6	0.87	19.1

* Data from several individual trees, all five years or older from budding; 1964 was a year of very small fruit at Riverside.

Seeds are many, medium sized with a short beak, usually plump and rounded but sometimes empty. Cotyledons are usually white. The seeds appear to be monoembryonic.

The tree is moderately vigorous and erect, with many slender branches, more dense than 'King' but less so than 'Willow Leaf.' Thorns are few. The bud union on sweet orange rootstock has been smooth; on 'Troyer' citrange there is moderate undergrowth of

scion at six years from budding. Bearing habit has been somewhat alternate, but not extremely so. The fruit is borne singly or in two's or three's, not in large clumps.

Leaves are slightly shorter and narrower than 'King,' lanceolate with tips usually acute. Leaf edges are faintly crenate at the distal end. Leaf petioles average 9 to 11 mm in length, clearly shorter than 'King'; petiole wings very narrow, narrower than 'King.'

The Pixie Mandarin

'Pixie' is a second-generation hybrid (or possibly a self) obtained from open pollination of an F_1 hybrid called 'Kincy.' The latter was a cross between 'King' (*Citrus nobilis* Lour.) as seed parent and 'Dancy' tangerine (*Citrus reticulata* Blanco). The second-generation seed was obtained in 1927 by Howard B. Frost, but testing was not begun until many years later. Fruit of 'Pixie' ripens at Riverside in April to May and remains good into July and sometimes into August. Fruit size is small to medium, $1\frac{1}{2}$ to $2\frac{1}{4}$ inches in transverse diameter, $1\frac{1}{4}$ to $2\frac{1}{4}$ inches in height. Fruit shape is variable, oblate to somewhat elongate; a neck structure may be short, medium, or absent. The rind is rather thin (2-4 mm) but not fragile; rind surface is grained to sometimes pebbled, with occasional furrowing at the stem end. The rind puffs very little. In surface view, oil glands are moderate in number, usually inconspicuous. There is no appreciable navel structure or opening. Rind color is yellow-orange to pale orange (Ridgway Plate III, 15a to 17b); full coloring is slow to develop in some seasons. The fruit peels easily, without dripping of juice and with little albedo adhering to the flesh.

The core is hollow from early maturity, but the fruit can be firm until summer. Segment membranes are usually thin-walled, easy to separate; the flesh is fine-textured, with small, slender juice vesicles. Flesh color is medium orange (Ridgway Plate III, 13 to 15). Total soluble solids are moderate to high, and acidity is rather low from early maturity (table 1). The taste is pleasant, milder than 'King' by early summer; the flesh sometimes becomes dryish by July.

Seeds are very rare, often 1 or 2 in a sample of 20 fruit. Mixed citrus plantings favorable to cross pollination have never caused seediness in 'Pixie.' Examination of the flowers in 1964 showed completely normal-appearing stigmas and styles, but abortion of mature pollen grains, from four trees, was 95 per cent or greater. Chromosome examination has shown that the normal diploid number ($2n = 18$) is present.

The tree is erect to somewhat spreading, unusually vigorous for a mandarin type, notably more vigorous than 'King.' Branches are stout and sharply ascending. Thorns are few and small. Scion undergrowth has been present with trifoliate orange root-

stock; undergrowth on 'Troyer' citrange is only slight at six years from budding. Bearing habit has been somewhat alternate. The tree bears a considerable proportion of inside fruits; outside fruits are subject to sunburn.

Leaves are lanceolate, broad at the middle, large for mandarin type. Leaf

tips are usually acuminate, edges crenate near tips, leaves less rounded at base than 'King.' Leaf petioles are 10-13 mm long on larger leaves, shorter than 'King' or 'Dancy'; petiole wings extremely narrow, sometimes nearly lacking.

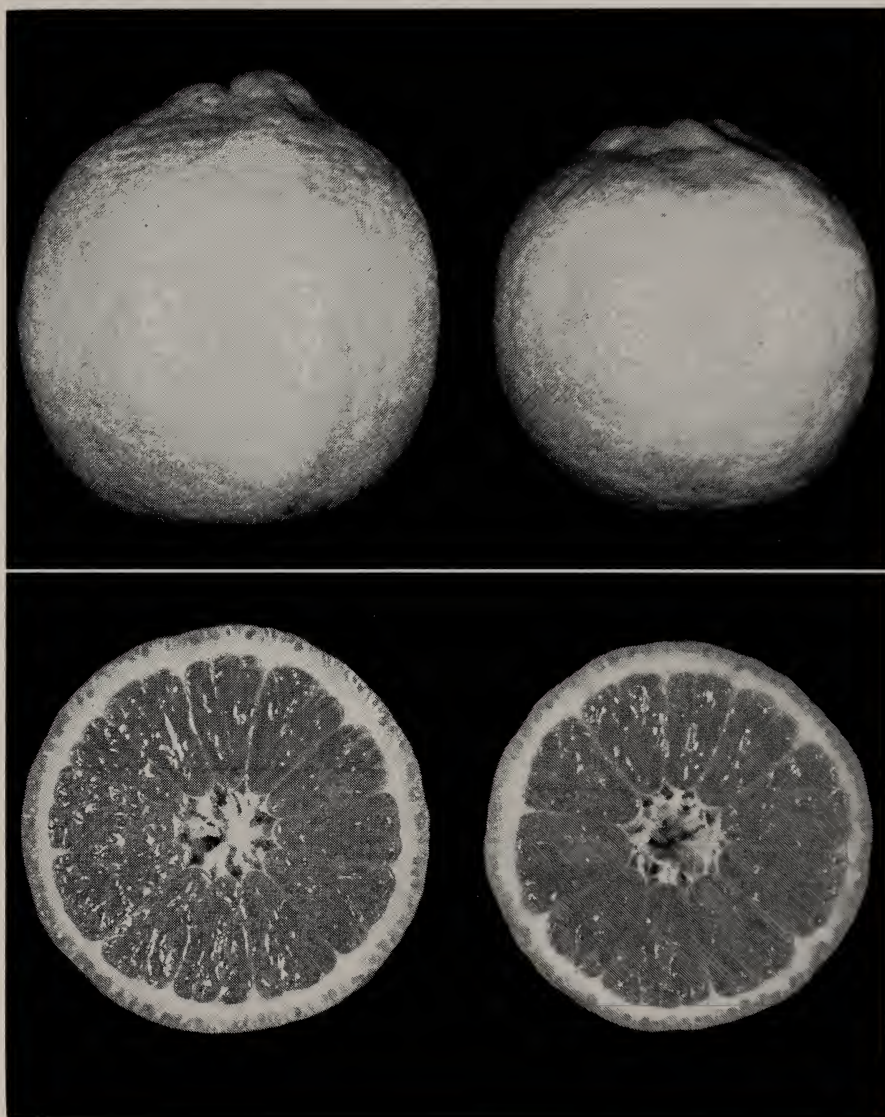


Fig. 2, The Pixie mandarin: seedless, easy to peel. Its season is April to July at Riverside. Natural size.

Advantages and Disadvantages of Encore and Pixie

'Encore' and 'Pixie' may have limited market potential because of certain features. Their lateness is both an advantage and a disadvantage. The small size of 'Pixie' and the pale rind color of both hybrids are questionable features, but their pleasant flavor and ease of handling are in their favor. It may be noted that 'King' has seldom imparted deep rind color to its progeny. Climatic effects on rind color and fruit size are very marked in citrus, and some growing areas will be more favorable than others for these fruits. Samples of 'Pixie' from Tulare, Ventura, and Orange counties have been

seedless and of good flavor; in the Coachella Valley desert area, fruit set has been very light and the fruit is dry.

'Pixie,' especially, should have appeal as a home garden fruit because of its seedlessness. In the case of 'Encore,' it is not yet certain whether isolated trees will set fruit without cross pollination by other citrus varieties.

Under the California domestic virus-indexing program, budlines of both hybrids have been maintained free from tristeza, psorosis, vein enation and, apparently, exocortis.

Literature Cited

Frost, H. B.

1935. Four new citrus varieties—the Kara, Kinnow, and Wilking mandarins and the Trovita orange. Calif. Agric. Exp. Sta. Bull. 597. 14 pp.

Frost, H. B. and J. W. Cameron

In press. Genetics, breeding, and nucellar embryony. In: The Citrus Industry, Vol. I, rev. ed. Chap. X. Edited by Walter Reuther. Univ. of Calif. Division of Agric. Sciences.

Furr, J. R., J. B. Carpenter, and A. A. Hewitt

1963. Breeding new varieties of citrus fruits and rootstocks for the Southwest. J. Rio Grande Valley Hort. Soc. 17: 90-107.

Ridgway, Robert

1912. Color standards and color nomenclature. Published by the author. Washington, D.C.

Ziegler, L. W. and H. S. Wolfe

1961. Citrus growing in Florida. University of Florida Press. Gainesville. 248 pp.